

OBSERVATIONS AT 8 P. M. EASTERN STANDARD TIME, (7:17 P. M. LOCAL.)

Date.	Tempera- ture.		Wind.		Upper clouds.			Lower clouds.		
	Air.	Dew-point.	Direction.	Force.	Kind.	Amount.	Direction from.	Kind.	Amount.	Direction from.
1.....	78	73	ne.	2		0				
2.....	79	73	ne.	2-3		0				
3.....	79.5	73	ne.	1		0				
4.....	79	73	ne.	2		0				
5.....	79	73	ne.	1				ks.	Few	ne.
6.....	79	73	se.	0.5				ks.	10	
7.....	79	74	w.	0.5		0			0	
8.....	78.5	74	se.	0		0			0	
9.....	77	71	ne.	2	cs.	10	ne.			
10.....	79	73	se.	0.5		0		k.*		
11.....	79	73	se.	1		0		nk.	Few	
12.....	79	73	se.	1				k.	10	se.
13.....	74	65	e.	3-4	c.	1	e.			
14.....	75	68	se.	2				ak.	4	se.
15.....	77	72	se.	2				d.k.	5	se.
16.....	78	72	se.	1				f.k.	1	se.
17.....	76	73	se.	1				ak.	10	se.
18.....	77.5	73	e.	2	ck.	8	e.			
19.....	77	73	ne.	1				ak.	9	ne.
20.....	79	73	ne.	1				ak.	10	ne.
21.....	79	73	se.	2	ck.	5	se.			
22.....	80.5	75	se.	1				k.	3	se.
23.....	81	74	se.	2				a.k.,k.	8	ne.
24.....	78	72	se.	2				k.	10	se.
25.....	80	73	se.	0	c.	Few	s.			
26.....	79	75	se.	1				f.k.	5	se.
27.....	79	73	ne.	3	ck.	Few	se.			
28.....	79	75	ne.	2				k.	10	ne.
Means.....	78.2									

*Cumuli on Ometepe.

The rainfall occurred as follows: 2d, sprinkle at 3 a. m.; 9th, rain at 3:15 and 9 a. m.; 12th, thunderstorm from 7 to 8 p. m.; 17th, sprinkle. 0.02 inch at 1 a. m., frequent showers reported at Tortuga, about 50 miles southeast of Rivas on the southwest shore of Lake Nicaragua; 18th, sprinkle at 5:45 p. m.; 19th, sprinkle, 0.10 p. m.; 21st, sprinkle at 1 p. m.

The barometric range for the month was 0.16. The lowest occurred on the 21st and the highest on the 14th. Cool waves occurred on the 9th and 14th. On the 8th calm and smoky with a light air from the southwest; a shower occurred 5 miles to the northward, and a sprinkle at Rivas; 9th, wind backed to northeast at 10 a. m.; 15th, phenomenal clouds from the south and southwest.

MEXICAN CLIMATOLOGICAL DATA.

Through the kind cooperation of Señor Mariano Bárcena, Director, and Señor José Zendejas, vice-director, of the Central Meteorológico-Magnetic Observatory, the monthly summaries of Mexican data are now communicated in manuscript, in advance of their publication in the *Boletín Mensual*; an abstract translated into English measures is here given in continuation of the similar tables published in the MONTHLY WEATHER REVIEW since 1896. The barometric means have not been reduced to standard gravity, but this correction will be given at some future date when the pressures are published on our Chart IV.

Mexican data for March, 1899.

Stations.	Altitude.	Inch. Mean barometer.	Temperature.			Relative humidity.	Precipitation.	Prevailing direction.	
			Max.	Min.	Mean.			Wind.	Cloud.
Colima.....	Feet. 1,600	Inch. 28.28	° F. 91.8	° F. 53.8	° F. 74.7	% 59	Inch.	sw.	sw.
Durango (Seminario).....	6,243	24.02	93.2	34.2	62.2	24	.....	sw.	e.
Guanajuato.....	6,640	23.69	87.3	42.3	65.3	38	.....	sw.	sw.,w,nw
Leon (Guanajuato).....	5,934	24.28	86.5	33.8	64.2	27	.....	s.	sw.
Mexico (Obs. Cent.).....	7,472	23.04	80.4	38.3	61.9	44	0.06	nw.	sw.
Morelia (Seminario).....	5,401	23.97	84.4	43.5	65.7	46	T	sw.	w.
Oaxaca.....	5,164	23.06	92.1	38.1	70.7	55	0.60	s.	sw.
Puebla (Col. Cat.).....	7,112	23.34	83.5	30.6	64.8	59	.....	ene.	sw.
Tuxpan (Vera Cruz).....	19	29.20	100.4	57.2	76.8	76	T.	e.	n.
Silao.....	6,063	24.36	82.9	41.7	66.7	39	.....	wnw.	w.
Zapotlan (Seminario).....	5,078	25.10	88.7	44.6	69.4	65	.....	sse.	ws.

WEATHER FORECASTING IN HONGKONG.

By W. DOBERCK, Director of the Hongkong Observatory (dated February 17, 1899).

In the law of storms in the eastern seas it is explained that all the phenomena connected with typhoons are natural consequences of the barometric gradients, and that the steepness of these cause enormous rainfalls, and that these tend to increase the gradients till the rainfall ceases for lack of water vapor when the center of the typhoon enters dry land. These phenomena are not qualitatively different from those experienced in colder climates. Although the climates feel so extremely different, there is scarcely sufficient difference in temperature to cause any substantial difference in the laws governing the weather. This is most apparent when the extreme differences in temperature are expressed on the absolute scale beginning with absolute zero.

In the northeast monsoon the wind blows practically always from the northeast, east, or east-southeast, as pressure is relatively lowest to the south. In midwinter the lowest pressure lies to the south of the equator, and in spring and autumn it lies to the north of the equator, a trough-shaped depression lying between the northeast and southwest winds. On the contrary, in the southwest monsoon there is no southwest wind in Hongkong unless there happens to be a depression to the north of the observer. A permanent depression inland in northern China or Siberia does not exist.

During the northeast monsoon, when the center of an anticyclone moving along eastward between preceding and following cyclones, passes comparatively close to Hongkong the weather clears there. The latitude of the centers of the anticyclones is generally about 35°, and perhaps never as low as 27°. The time when the northeast wind is strongest is not when the center is just north of or nearest to Hongkong, but occurs usually when the center is past, because the high pressure spreads to the south and southeast, so that pressure continues rising along the south coast of China after the center is past.

When during the northeast monsoon a low pressure advances across north China and Korea it seldom causes southwest wind in Hongkong, but only calms or very light winds. At the same time southwest winds are frequently reported from Saigon and the southern Philippines, apparently against the gradient. This is caused by local shallow low pressures over the land, which becomes intensely heated, owing to the absence of the usual northeast monsoon and owing to the clear sky and hot sunshine. Such southwest breezes must have a diurnal period like land and sea breezes, and they do not blow at sea except very near land.

Northers in Hongkong are just like northers in Texas. They occur with falling temperature after very hot days in winter and spring. In case of high barometric areas over north China, Korea, and Japan sometimes a V-shaped depression with isobars open toward the south is formed near Formosa. Such a depression develops into a cyclone moving toward Japan.

While the weather in Hongkong in winter depends upon the latitude in which the cyclones and anticyclones are crossing to the northward, it depends in summer upon the latitude of the troughs.

Mr. A. G. Figg, who officiates as weather forecaster in Hongkong, states that there appears to be a general agreement in recent years between droughts in India and droughts in Hongkong.

Before a period of foggy weather sets in we note an upper current from south or southwest above the east wind. Then fog occurs along the coast, which is cooler than the sea, with light (usually east) wind. With west wind the coast is not so cool, and therefore fog is not so likely to occur as with east wind or calm.

Thunderstorms occur when gradients disappear with change of gradient, for instance, occasionally, before a typhoon; when the weather is hot; and especially, when the wind is northwest and it is very hot inland in China. Mr. Figg has sometimes noted jumps in the barometer readings before as well as during thunderstorms. He states that when they approach from the landside there is very little rain, while if they come up from the seaside there is great rain.

SELENIUM AND ITS USE FOR THE MEASUREMENT OF SUNSHINE.

By N. ERNEST DORSEY, Ph. D., of Johns Hopkins University (dated April 17, 1899).

Owing to frequent inquiries as to the suitability of some form of the selenium cell as a continuous and exact sunshine recorder, it has been deemed advisable to publish in this REVIEW a short account of what is known in regard to the selenium cell, especially with respect to this use.

The fact that the resistance of selenium is changed by the action of light was first announced by Willoughby Smith in 1873. He wished to use selenium bars with platinum wire electrodes melted into their ends as high resistances to be used in connection with submarine cables. His assistant found that the resistances of these bars were very inconstant, and this variability was found to be due to the varying illumination of the bars. It was found that the decrease of resistance noticed when the bars were illuminated was due to the visible radiation, and appeared to be instantaneous. Smith suggested that this effect might possibly be explained by the fact that selenium conducts electricity only when in the crystalline condition, and that light favors crystallization.

Immediately upon the publication of Smith's paper Lieutenant Sale, and also the Earl of Rosse, repeated and verified Smith's observation. The latter suggested that this property of selenium might be used as a means of measuring the intensity of light, as he found that the decrease of resistance is almost proportional to the square root of the intensity of the illumination.

In 1875 Werner Siemens went over this work again and then undertook the study of the effect of the physical state of the selenium upon its sensitiveness to light. He found that by protracted heating of amorphous selenium at $210^{\circ}\text{C}.$, or by cooling melted selenium to this temperature (at which, with a longer duration of it, the selenium passes into a coarsely granular, crystalline state), he obtained a modification of crystalline selenium which possesses and retains a considerably greater conductivity than otherwise. It is also far more sensitive, and the decrease of its resistance due to its exposure to light appeared to be constant. He constructed the first of the so-called selenium cells, which he describes as follows: "By fusing into coarsely granular selenium two flat spirals of wire at the distance of about one millimeter from each other, I produced an extraordinarily sensitive photometer." Obscure heat rays were without effect upon this cell, while diffused daylight doubled its conductivity, and direct sunlight increased its conductivity, at times, tenfold.

Prof. W. G. Adams and R. E. Day now undertook investigations on this subject and in 1877 they published in the Philosophical Transactions a long and exhaustive article on the subject. Besides obtaining results similar to those already described, they found that the resistance of the selenium cell generally decreased with an increase of the current through it, and depended upon the direction of the current. They also found that the cells became polarized on the passage of a current; that the change of resistance due to illumination depended upon the end illuminated; that when no current was passing through the cell the action of light on the cell could give rise to a current through it, but in regard to this latter property they say:

It appears that three pieces of the same length, made from the same rod, and annealed together may, owing to some slight difference in molecular condition, be very different as to their relative sensitiveness to the action of light.

It was also observed that a slight heating produces a great increase in the resistance, which also changes very greatly with the time; they appear to anneal slowly.

In 1878 Sabine studied the resistance of the fused-in electrodes and found that it was very great and depended upon the direction, strength, and duration of the current passing through the cell.

In 1884 C. E. Fritts described a new form of the selenium cell which is much more sensitive than any of these others. He melts a thin layer of selenium upon a metal plate with which it will form a chemical combination at least sufficient to cause the selenium to adhere to it and make good electrical connection, the other surface of the selenium is covered with a transparent conductor, generally gold leaf, through which the current is passed into the selenium. Like other kinds of selenium cells the resistance of these depends upon the strength and direction of the current and the temperature and age of the cell.

In 1888 Uljanin investigated this subject and explained the observed phenomena much in the same way as Smith first suggested. He assumed that the annealed selenium consists of various allotropic forms of selenium, some of which are conductors and some are not, and the action of light is supposed to favor the change from one form to the other. He gives a good résumé of the work up to this time.

In a series of articles published in the Philosophical Magazine, from 1881 to 1895, Bidwell points out that all the properties of the selenium cells which have been so far discovered suggest that the conduction through these cells is electrolytic in character. The selenium is probably a non-conductor, and the current is carried by metallic selenides contained in the selenium. In support of this he finds that selenium which has never touched metals but has been annealed in glass has a much higher resistance than that annealed in the ordinary way; and, furthermore, its resistance is decreased by the addition of metallic selenides, so that it behaves like ordinary selenium. He also found that certain specimens of selenium which were entirely insensitive to light, were rendered very sensitive by the addition of selenides. And, finally, he succeeded in constructing a cell composed of sulphur and silver sulphide which behaved exactly like the selenium cell. His last article, published in the Proc. Phys. Soc. 13, 1894, pp. 552-579, and Phil. Mag. (5) 40, 1895, pp. 233-256, contains the best and most recent résumé of the entire subject.

From this we see that while selenium cells may be used for very rough determinations of the intensity of illumination, they are eminently unsuitable for any exact photometric work. Owing to the fact that the resistance varies with the strength and duration of the current, and with the temperature, and with the entire past history of the selenium, each cell would have to be carefully studied in order to obtain the coefficients of these various factors, and after this was done these coefficients would be correct for but a very short time, on account of the unknown and variable change of the resistance and electromotive force of the selenium cell with its age.

The best articles on this subject are as follows: Willoughby Smith, Nature, 5, 1873, pp. 303 and 361; Am. Jour. Science, (3) 5, 1873, p. 301. Lieutenant Sale, P. R. S., 21, 1873, p. 283; Pogg. Ann., 150, p. 333; Phil. Mag. (4) 47, 1874, p. 216; Earl of Ross, Phil. Mag. (4) 47, 1874, p. 161; Werner Siemens, Monatsberichten der kön. preuss. Akad. d. Wissenschaften zu Berlin, 1875, p. 280; Phil. Mag. (4) 50, p. 416; Pogg. Ann., 149, p. 140; W. S. Adams and R. E. Day, Phil. Trans., 167, 1877, pp. 313-349; Proc. Roy. Soc., vols. 23, 24, 25; Sabine, Phil. Mag. (5) 5, 1878, p. 401; Bell, Proc. A. A. A. S., 29, 1880;